

## Seven new species of *Heliotropium* (Boraginaceae) from the monsoon and arid zones of Australia

LYN A. CRAVEN

Australian National Herbarium, CPBR, CSIRO Plant Industry,  
GPO Box 1600, Canberra ACT 2601, AUSTRALIA

### ABSTRACT

Seven new Australian species of *Heliotropium*, *H. albrechtii*, *H. arenitense*, *H. argyrium*, *H. lapidicola*, *H. microsalsoloides*, *H. mitchellii* and *H. viator*, are described and their distributions mapped. Partial identification keys are provided to enable the new taxa to be integrated in a recent revision (Craven) of the Australian species. The generic circumscription of *Heliotropium* is discussed and a broad definition of the genus is retained.

KEYWORDS: Boraginaceae, *Heliotropium*, *Euploca*, new species, Australia, Northern Territory, Western Australia.

### INTRODUCTION

The Australian species of *Heliotropium* L. were revised by Craven (1996) who recognised 81 species for the region of which 78 are indigenous (with 75 of these being endemic) with the remaining three species being introduced and naturalised as a result of the activities of European settlers and/or traders. The Australian species typically are annuals to perennials, and in habit may be cushion forming (Fig. 1) but more usually are subshrubs (Fig. 2). Since the revision was finalised, this being several years before its ultimate publication in 1996, material of several distinctive new Australian species became available and several more have been collected in more recent years. Reconsideration of the taxonomic status of some anomalous collections included in *H. ovalifolium* Forsskål in the 1996 revision has resulted in the conclusion

that two additional species should be recognised. With the impending publication of a volume in the *Flora of Australia* series that will include Boraginaceae, seven new Australian species of *Heliotropium* are described below in advance of the flora account.

The codes of the cited herbaria are as given in *Index Herbariorum* (Anonymous 2005). The species are numbered herein as to where they should be inserted in the revision by Craven (1996). For example, species 8a. *H. argyrium* should be inserted after species 8 in the revision, *H. pleiopterum* F. Muell., and so on. But note, however, that the positioning of a new species in the sequence does not imply that it is necessarily related to the preceding species; in the case of *H. argyrium*, its relationships are with the *H. ovalifolium* subgroup, not with sect. *Heliotropium*. The relationships of the new species are indicated under the subheading Remarks.



Fig. 1. *Heliotropium pulvinum* Craven, a perennial that forms small cushions.



Fig. 2. *Heliotropium tenuifolium* R.Br., a short-lived perennial subshrub.

## GENERIC CONCEPTS

Hilger and Diane (2003) proposed that Boraginaceae subfam. Heliotropioideae (as Heliotropiaceae) be redefined to comprise five genera: *Euploca* Nutt., *Heliotropium*, *Ixorhea* Fenzl, *Myriopus* Small and *Tournefortia* L. In their scheme, the majority of the Australian species of *Heliotropium* including those being treated here, belong to *Euploca*, with the balance remaining in *Heliotropium* (which on the data of Hilger and Diane (2003) includes *Tournefortia* s.s., although they advocated the continued recognition of this taxon (apparently in part due to its longstanding acceptance by authors, Hilger, pers. comm.)). The clade names used by Hilger and Diane (2003) will be used where appropriate in the following discussion; these are: EUPLOCA (= *Euploca*), and HELIOTROPIUM I and HELIOTROPIUM II (both = *Heliotropium*).

The defining morphological and anatomical features of EUPLOCA *sensu* Diane (2003), Diane *et al.* (2003), Diane *et al.* (in press) and Hilger and Diane (2003) apparently are the following: leaves lacking glandular hairs; strigose leaf hairs on a pedestal of enlarged epidermal cells; Kranz-chlorenchyma organisation in the leaves of most species; leaves lacking crystal druses but with crystal needles present; corolla lobes with the margin involute; anther apices cohering and closing the corolla tube; mericarp with surface pits; embryo curved.

Contrary to Diane (2003) and Diane *et al.* (2003), glandular trichomes do occur in EUPLOCA, being present in *H. aenigmatum* Craven and *H. glanduliferum* Craven (Craven 1996). Stout leaf hairs on a pedestal of enlarged epidermal cells occur in *H. asperrimum* R. Br. (HELIOTROPIUM II) and the feature may be of sporadic occurrence outside EUPLOCA. Of 14 species of EUPLOCA examined by Diane *et al.*, all lack crystal druses and tubes with crystal needles occurring in only two species (Diane *et al.* 2003) whereas in HELIOTROPIUM I and II druses and tubes occur more commonly and needles have not yet been reported. Even so, of the 29 species of HELIOTROPIUM I and II studied by Diane *et al.* (2003), 12 altogether lack crystals of any form. Kranz-chlorenchyma tissues were observed by Diane *et al.* (2003) in all studied EUPLOCA species with the exception of two species belonging to *H.* subsect. *Ebracteata* I.M. Johnst. (*H. ovalifolium* and *H. procumbens* Mill.); Kranz-type anatomy was not observed in HELIOTROPIUM I and II.

Diane *et al.* (in press) give cochlear aestivation as being the most common type of corolla aestivation in HELIOTROPIUM I and II but they note that quincuncial, apert-introflex, apert-duplicative and vicinal-cochlear aestivation may also be found. They state that EUPLOCA is characterised by “usually apert aestivation (rarely indistinctly cochlear) and pre-anthetically involute

corolla lobes”. The coherent anthers that tend to close the corolla tube in many species of EUPLOCA were believed by Craven (1996) to be associated with inbreeding as the anthers form a ‘cap’ over the stigma, effectively inhibiting the removal and/or deposition of pollen by insects.

The presence of two surface pits together with the presence of oil bodies on the adaxial mericarp surface in many species of EUPLOCA may represent a specialised evolutionary trend towards myrmecochory from a more generalised form. *Heliotropium europaeum* L. (HELIOTROPIUM II) lacks surface pits but does possess on the adaxial surface of each mericarp a central, distinctly oily tissue which, together with the subfleshy exocarp, may be an adaptation to endozoochory. Craven (1996) discussed oil bodies (as ‘food bodies’) with respect to their occurrence in EUPLOCA but did not record the presence of the analogous oily tissue in HELIOTROPIUM II (i.e., in *H. europaeum*). My observations of the embryo are that it is straight in *H. europaeum* (HELIOTROPIUM II), slightly curved in *H. amplexicaule* Vahl (HELIOTROPIUM II), moderately curved in *H. asperrimum* (HELIOTROPIUM II), and distinctly curved in *H. inexplicitum* Craven and *H. ovalifolium* (both EUPLOCA).

None of the differences between EUPLOCA and HELIOTROPIUM I and II noted above are particularly strong and, even when taken in combination, they do not make a convincing argument for the recognition of *Euploca* as a genus distinct from *Heliotropium*. The presence/absence of crystals is quite variable and the different structural forms of the crystals are perhaps more applicable to infrageneric than to generic classification. Kranz-type anatomy is an evolutionary innovation that may have some significance for classification but this is lessened by its absence in subsect. *Ebracteata* of EUPLOCA. Corolla aestivation in HELIOTROPIUM I and II apparently is quite variable and it seems that overlapping variation may occur in EUPLOCA. While the bifacial mericarps, commonly with oil bodies, are a very characteristic feature of EUPLOCA, the comparable features in HELIOTROPIUM II are less developed and are indicative that in these aspects EUPLOCA species are more highly specialised. The curvature in the embryo in EUPLOCA is very pronounced relative to that in *H. europaeum* but this distinction is lessened by the curvature present in other HELIOTROPIUM II species such as *H. amplexicaule* and *H. asperrimum*.

Based on the available evidence from literature, and on my own observations of the flower and fruit morphology of the Australian indigenous and naturalised species of *Heliotropium* as the genus is traditionally circumscribed, it is my belief that all of them should be classified in the same genus. Consequently, the following new species are described in *Heliotropium*.

SYSTEMATICS

Boraginaceae  
*Heliotropium* L.

8a. *Heliotropium argyreum* Craven sp. nov.

(Fig. 3)

A *H. ovalifolium* Forsskål ramulis trichomatibus classis majoris pernumerosis et eis minoris persparsi differt.

**TYPUS:** Australia, Western Australia, Hillside Road, 3.2 km from Woodstock Homestead, 23 April 1958, *Burbidge 5825* (holotype: CANB; isotype: PERTH).

**Description.** Perennial subshrub, hermaphroditic, ascending, up to c. 20 cm tall. Branchlets with hairs predominantly of one class (sparse small curved hairs also occur), the hairs dense, appressed to ascending. Leaves 7–12 mm long, 1.5–2 mm wide, short-petiolate. Leaf blade revolute, narrowly oblong-elliptic, narrowly elliptic to narrowly obovate; abaxial surface with the hairs uniformly distributed, the hairs of one class and dense and appressed. Cymes simple or 2-branched, without bracts or leaves. Calyx lobes with the hairs on the abaxial surface as on the leaf blade. Corolla white, 3.5 mm long. Anthers very narrowly ovate, 1.2 mm long, the apex long acuminate, coherent at the apex. Gynoecium 1 mm long; ovary 0.3 mm long; style 0.1 mm long; stigmatic apparatus 0.5 mm long, the disc relatively short (0.1 mm) and the cone long (0.4 mm). Mericarps with macrohairs, the hairs appressed to spreading-ascending and up to c. 0.5 mm long; elliptic-ovate, 1.2 mm long, 1.3 times as long as wide, the apex acute; commissures not pitted, with a very weakly developed food body.

**Distribution and ecology.** *Heliotropium argyreum* has been recorded from a single locality in the northern Pilbara region of Western Australia (Fig. 10) where it was noted to grow on loose rubble on a limestone ridge.

**Remarks.** Craven (1996) included material of this species in the concept of *H. ovalifolium* adopted in the revision, albeit with reservations due to the indumentum of dense, appressed to ascending large hairs and paucity of small hairs. The opportunity has now been taken to reconsider the taxonomic status of both Pilbara forms of *H. ovalifolium* mentioned by Craven (1996: 560) and it is concluded that separate recognition is warranted for both. The second form, from the Meekatharra region, is described below as *H. mitchellii* Craven.

**Etymology.** The epithet is derived from the Greek word, *argyros*, silver, in reference to the silvery foliage that this species possesses.

12a. *Heliotropium mitchellii* Craven sp. nov.

(Fig. 4)

A *H. ovalifolium* Forsskål ramulis trichomatibus classis majoris plerumque sparsis et eis minoris pernumerosis, et mericarpiis majoris (2 mm longis) differt.

**TYPUS:** Australia, Western Australia, 42 km SE of Meekatharra on the Sandstone road, lower slopes of Mt. Yagahong, 9 September 1982, *Craven 7531* (holotype: CANB; isotypes: A, E, L, MEL, PERTH, W).

**Other specimens examined.** Australia. Western Australia: c. 18 km W of Meekatharra, 3 September 1957, *Speck 592* (CANB); 15 km W of Hillview Homestead on slopes of the Yagahong basalt, 25 March 1984, *Mitchell 1217* (CANB); Mt. Meekatharra, 1 August 1966, *Fairall 2183* (CANB); Gabanintha Hill, SE of Meekatharra, August 1963, *Gardner 14474* (CANB, PERTH).

**Description.** Perennial subshrub, dioecious, ascending to spreading, up to c. 40 cm tall. Branchlets with hairs of two classes, the hairs of the larger class usually sparse, appressed to ascending, and of the smaller class very dense, curled and appressed to recurved. Leaves 5–22 mm long, 3–6 mm wide, short-petiolate. Leaf blade flat, elliptic to obovate, sometimes narrowly so; abaxial surface with the hairs uniformly distributed, the hairs of the larger class appressed and of the smaller class curled to straight and appressed to recurved. Cymes during anthesis curled, simple or 2-branched, without bracts or leaves. Calyx lobes with the hairs on the abaxial surface as on the leaf blade. Corolla white to creamy white with a yellow throat, 5.3–6 mm long. Anthers (in male functional flowers) very narrowly ovate to sublinear, 1 mm long, the apex long acuminate, coherent at the apex. Gynoecium (in female functional flowers) 1.7 mm long; ovary 0.7 mm long; style 0.3 mm long; stigmatic apparatus 0.7 mm long, the disc relatively short (0.2 mm) and the cone long (0.5 mm). Mericarps with macrohairs, the hairs appressed to ascending and up to c. 0.5 mm long; oblong-elliptic, 2 mm long, 1.7 times as long as wide, the apex acute to obtuse; commissures only slightly pitted, with a weakly developed food body.

**Distribution and ecology.** *Heliotropium mitchellii* has been recorded in the Meekatharra region of Western Australia (Fig. 10) and has been noted to grow on sandstone talus/screes with open mulga shrubland, on very stony ground, under *Acacia linophylla*, and on boulder-strewn basaltic soil with *Eremophila-Acacia* scrub.

**Remarks.** Craven (1996) included this plant in his concept of *H. ovalifolium* although, as noted above under *H. argyreum*, it was considered atypical for that species. The Meekatharra plant has indumentum with the hairs of the larger class mainly distributed sparsely and of the smaller class distributed very densely. In addition, the mericarps are larger than in *H. ovalifolium* s.s. These differences are now considered to be taxonomically significant and accordingly a new species is described.

**Etymology.** The species is named in honour of Andrew Arthur Mitchell, formerly of Meekatharra, Western Australia, and presently of Darwin, Northern Territory. Andrew developed considerable familiarity with the flora of the eastern Pilbara region while conducting rangeland assessment studies there and has made many important

53749  
CANBERRA



**HERBARIUM AUSTRALIENSE**  
DIVISION OF PLANT INDUSTRY—CSIRO—CANBERRA

No. 5825 Date 23.iv.1958

Name *Heliotropium ovalifolium*  
Var. *oblongifolium*

Hab. loose rubble on limestone  
ridge  
Loc. Hillside Rd., 2 miles from  
Woodstock H.S., W.A.  
Coll. N.T. Burbidge

Det.  
Notes: erect perennial herb. Flowers  
white

*Heliotropium argyreum*  
Craven

CSIRO, DIVISION OF PLANT INDUSTRY  
*Heliotropium ovalifolium* Fend.  
var. *oblongifolium* X.  
Determined by N.T. Burbidge 2/58

determined by L.A. Craven  
Australian National Herbarium (CANB)

2005

25mm

Specimen in Pennington  
Jan 1996

Fig. 3. *Heliotropium argyreum* Craven, holotype.

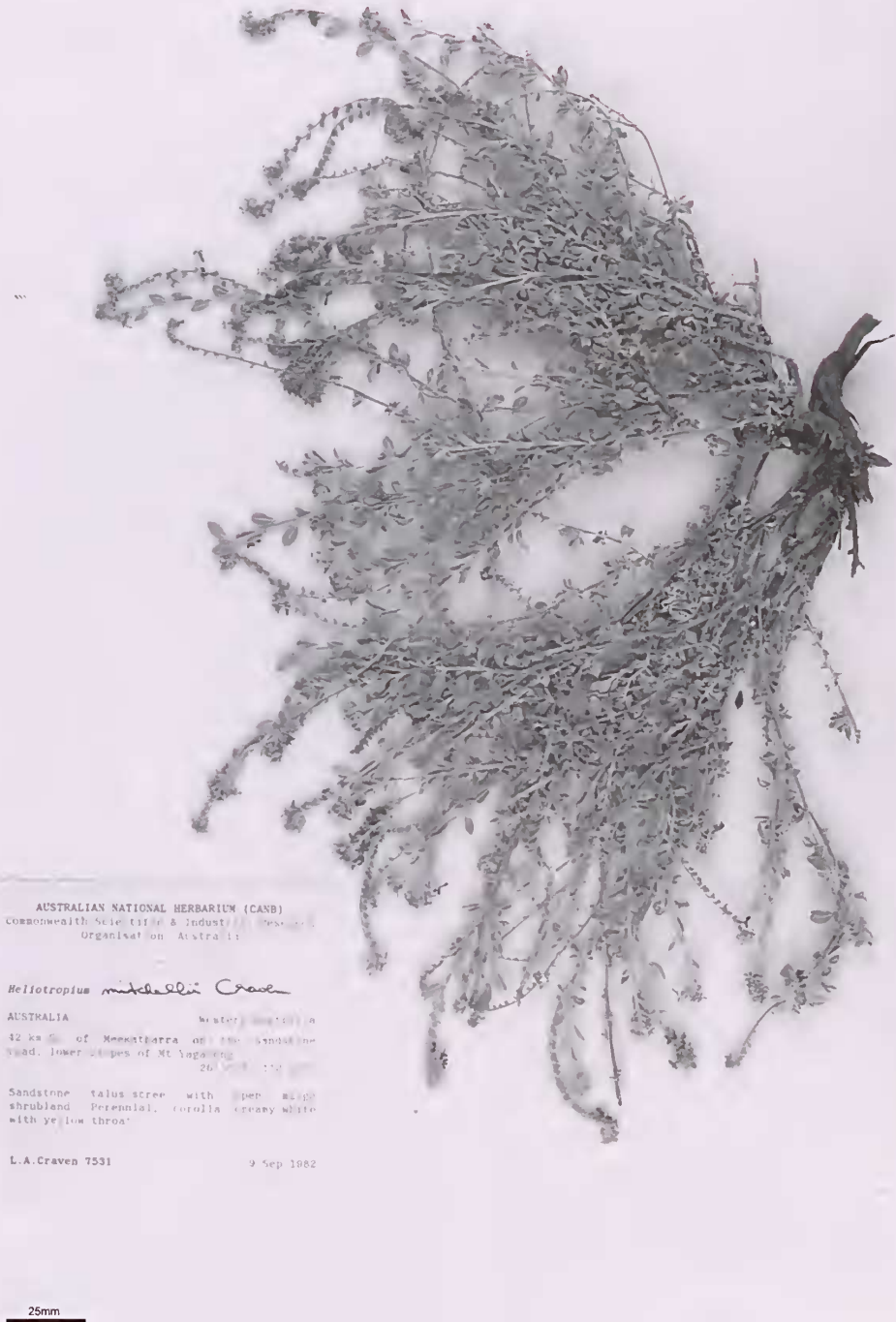


Fig. 4. *Heliotropium mitchelli* Craven, part of holotype.

contributions to our knowledge of the heliotrope flora of the Australian western arid zone, including making the second and third collections of the unusual species *H. muticum* Domin that was first collected in the latter part of the 19<sup>th</sup> century.

**23a. *Heliotropium arenitense* Craven sp. nov.**

(Fig. 5)

*A. H. frohlichii* Craven ramulis foliisque trichomatibus patentiascendentibus usque patentibus, eymis 1–2-floris, et mericarpis glabris differt.

**TYPUS:** Australia, Northern Territory, Kakadu National Park, 6.5 km NE of El Sharana, on a tributary of Koolpin Creek, 22 April 1990, *Slee & Craven 2755* (holotype: CANB; isotypes: A, B, BRI, DNA, E, G, L, M, MEL, NSW, P, US, W).

**Other specimens examined.** Australia. Northern Territory: Kakadu National Park, [near type locality,] 22 April 1990, *Dunlop & Munns 8610* (BRI, CANB, DNA).

**Description.** Perennial subshrub, hermaphroditic, sprawling, up to c. 30 cm tall. Branchlets with hairs of one class, the hairs dense, spreading. Leaves 6–15 mm long, 0.7–1.2 mm wide, short-petiolate. Leaf blade revolute, linear; hairs on the abaxial surface uniformly distributed, spreading-ascending to spreading. Cymes 1–2-flowered, bracteate. Inflorescence bracts on the abaxial surface with the hairs fine, and as on the leaf blade. Calyx lobes with the hairs on the abaxial surface as on the inflorescence bracts. Corolla white with a yellow throat, 4.5–5 mm long. Anthers ovate, 0.7 mm long, the apex acuminate, coherent at the apex. Gynoecium 1.4 mm long; ovary 0.4 mm long; style 0.5 mm long; stigmatic apparatus 0.5 mm long, the disc (0.2 mm) fairly equal in length to the cone (0.3 mm). Mericarps glabrous; oblong-ovate, 1 mm long, 1.4 times as long as wide, the apex obtuse; commissures strongly pitted, the pit suborbicular, with a very weakly developed food body.

**Distribution and ecology.** *Heliotropium arenitense* has been recorded only on the sandstone plateau in the El Sharana region of the Northern Territory (Fig. 10) where it grows among rocks on scree in very open *Eucalyptus miniata* woodland.

**Remarks.** The affinities of this species are difficult to assess. The combination of short, spreading hairs, one to two-flowered cymes, hermaphroditic flowers and glabrous mericarps set *H. arenitense* apart from its other Australian congeners. Possibly it is related to the species of the *H. tenuifolium* subgroup but it could well prove to be a hermaphroditic member of the *H. epacridemum* subgroup as it has some similarities with *H. frohlichii* Craven and *H. lapidicola* Craven in the foliage; it is tentatively assigned to the latter subgroup. In the Northern Territory, it is the only species of the genus that appears to be restricted to unmetamorphosed sandstones; other species that may occur on these substrates in the Territory are not confined to them. However, it is acknowledged that the species

is very poorly known, the two collections known to me having been made on the same day and from localities very close together, and it may be found to be more widely distributed than is presently known.

**Etymology.** The specific epithet is derived from the geological name for sandstone, arenite, and refers to the colloquial name used for the sandstone plateau country of northern Australia, i.e. 'the sandstone'.

**28a. *Heliotropium lapidicola* Craven sp. nov.**

(Fig. 6)

*A. H. frohlichii* Craven ramulis foliisque trichomatibus patentiascendentibus usque patentibus, et mericarpis ovatis et commissuris cum penu differt.

**TYPUS:** Australia. Queensland, Maronan Station, Fullarton River garnet locality (148.6 km ESE of Mount Isa by air), 15 May 2001, *Fraser 357* (holotype: BRI; isotypes: A, CANB, E, L, MEL).

**Other specimens examined.** Australia. Queensland: Maronan Station, Fullarton River garnet locality (148.6 km ESE of Mount Isa by air), 29 March 2002, *Fraser 372* (AD, BRI, CANB, DNA, G, K, L, MEL, P, W), 31 March 2002, *Fraser 374* (A, BRI, CANB, L, M, P, US).

**Description.** Perennial subshrub, dioecious, sprawling to bushy, up to 40 cm tall. Branchlets with the hairs of one class, the hairs dense, spreading-ascending to spreading. Leaves 8–45 mm long, 0.7–3 mm wide, sessile. Leaf blade revolute, linear to narrowly oblong; hairs on the abaxial surface coarse and uniformly distributed, ascending on the midrib, appressed on the lamina, and ascending to spreading-ascending on the margin. Cymes simple, straight at anthesis, bracteate. Inflorescence bracts with the hairs on the abaxial surface uniformly distributed and oriented as on the leaves. Calyx lobes with the hairs on the abaxial surface coarse in female plants and much finer in male plants, uniformly distributed, the hairs appressed to ascending on the lamina and midrib and ascending to spreading-ascending on the margin, with those on the margin generally shorter in length than those on the lamina. Corolla white, 2.8–3 mm long. Anthers (in male functional flowers) ovate, 1 mm long, the apex acuminate, coherent at the apex. Gynoecium (in female functional flowers) 2.2 mm long; ovary 0.6 mm long; style 1.1 mm long; stigmatic apparatus 0.5 mm long, the disc (0.2 mm) fairly equal in length to the cone (0.3 mm). Mericarps with microhairs, the hairs appressed and up to c. 0.2 mm long; ovate, 1.5–1.6 mm long, 1.5–1.6 times as long as wide, the apex obtuse; commissures moderately pitted, the pit elliptic, with a food body.

**Distribution and ecology.** *Heliotropium lapidicola* has been recorded from the Fullarton River region in Queensland (Fig. 10), growing on a rocky schistose ridge with acacias, low shrubs and herbs, and a few stunted eucalypts.

**Remarks.** This species is clearly closely related to *H. frohlichii*, having leaves that are similar in shape,

New species of *Heliotropium* (Boraginaceae)



25mm

Flora of AUSTRALIA  
AUSTRALIAN NATIONAL HERBARIUM (CANB)  
BORAGINACEAE

*Heliotropium arenitense* Craven

AUSTRALIA: Northern Territory

Kakadu National Park, 6.5 km NE of El Sharana, (on tributary of  
Koolpin Creek).

2nd rel. JHM JHM sheet 55471-397109 (1:100000).

13° 27' S 132° 35' E

Edge of sandstone pavement just up out of shallow creek; very  
open *Eucalyptus miniata* woodland.

Densely branched sub-shrub to 30 cm tall, rooted amongst  
rocks, flowers white with yellow throat.

A. V. Slee, L. A. Craven 2755

22 Apr 1990



CANSB 397768.1

Fig. 5. *Heliotropium arenitense* Craven, part of holotype.



25mm

Flora of AUSTRALIA  
Ex AUSTRALIAN NATIONAL HERBARIUM (CANB)  
BORAGINACEAE

*Heliotropium lapidicola* Craven

AUSTRALIA: Queensland  
Fullarton River gamet locality, Maroon Station, 148.6 km ESE  
of Mt Isa (by air)  
21° 09' 22" S 140° 50' 29" E

Rocky, schistose ridge with acacias, low shrubs and herbs, few  
stunted eucalypts  
Low, fairly bushy, sprawling, grey-green, somewhat shrubby  
plants to 43 cm. Flowers white, more or less cylindrical  
Commisssure pits with well developed food bodies

Scattered along ridge top  
A. Fraser 357 15 May 2001



Fig. 6. *Heliotropium lapidicola* Craven, holotype.



similarly structured cymes, generally similar gynoeceium, etc. The two species differ especially in the possession by *H. lapidicola* of spreading/spreading-ascending hairs on most of the organs, the comparable indumentum in *H. frohlichii* being appressed. The mericarps of *H. lapidicola* have food bodies, unlike *H. frohlichii*.

**Etymology.** The specific epithet is derived arbitrarily from the Latin *lapis*, precious stone, gem, jewel, and *-cola*, dweller, inhabitant, in reference to the occurrence of this plant at the Fullarton River garnet locality.

**28b. *Heliotropium microsalsoides* Craven sp. nov.**

(Fig. 7)

*A. H. epacrideo* F. Muell. ex Benth. foliis angustioribus (0.4–1.3 mm latis), et mericarpis oblongo-obovatis usque oblongo-ovatis 1.5–1.8 mm longis et commissuris sine pongo differt.

**TYPUS:** Australia, Western Australia, King Sound, Sunday Island, at site of abandoned mission station, 2 June 1993, *Craven & Stewart 9271* (holotype: CANB; isotypes: A, AD, B, DNA, E, G, K, L, M, MEL, P, PERTH, UC, US, W).

**Other specimens examined.** Australia, Western Australia: King Sound, Sunday Island, 24 September 1988, *Carter 328* (PERTH), 1 April 1992, *Mitchell 2234* (CANB, PERTH), 25 August 1993, *Carter 673* (PERTH), *Mitchell 3289* (CANB, PERTH), 4 April 2000, *Mitchell 6098* (CANB); Cone Bay Hermits Camp, 4 July 1996, *Kenneally 11710* (PERTH); Xerxes camp about 1 km NW of Alcatraz Island in Cone Bay, 31 May 1995, *Mitchell 3980* (CANB); 30 km ESE of Sale River mouth at junction of unnamed creek, 13 May 1986, *Kenneally 9615* (PERTH).

**Description.** Perennial subshrub, dioecious, erect to spreading, up to c. 35 cm tall. Branchlets with the hairs fine relative to those on the leaves and calyx, the hairs of two classes (sometimes appearing to be one class when the hairs of the larger class are sparse to absent), the hairs dense to moderately dense, those of the larger class spreading-ascending and of the smaller class ascending, spreading or recurved. Leaves 1.5–6 mm long, 0.4–1.3 mm wide, sessile. Leaf blade very slightly revolute, narrowly elliptic to narrowly ovate; hairs on the abaxial surface coarse and usually distributed more towards the midrib and central part of the lamina than towards the margin, appressed on the lamina and midrib and spreading-ascending on the margin. Cymes 1-flowered. Calyx lobes with the hairs on the abaxial surface coarse and uniformly distributed or sometimes absent on the lamina towards the margin, the hairs appressed on the lamina and midrib and spreading-ascending on the margin, with those on the margin generally equal in length to those on the lamina. Corolla white, 2.5–3 mm long. Anthers (in male functional flowers) ovate, 0.8 mm long, the apex acuminate, not coherent at the apex. Gynoeceium (in female functional flowers) 0.8 mm long; ovary 0.3 mm

long; style 0.25 mm long; stigmatic apparatus 0.25 mm long, the cone obsolete. Mericarps with microhairs, the hairs appressed to ascending and up to c. 0.15 mm long; oblong-obovate to oblong-ovate, 1.5–1.8 mm long, 1.4–1.5 times as long as wide, the apex obtuse; commissures strongly pitted, the pit elliptic, without a food body.

**Distribution and ecology.** *Heliotropium microsalsoides* has been recorded from the Buccaneer Archipelago-Sale River region in Western Australia (Fig. 10), growing among rocks and in fissures on sandstone, and in hummock grassland on sandstone cliffs.

**Remarks.** The *gestalt* of this remarkable little plant at first suggests it might be a species of Chenopodiaceae. The leaves are closely clustered on very short, secondary shoots and, together with the bristly leaf hairs, give the plant a very chenopodiaceous aspect. Its relationships are with *H. epacrideum* F. Muell. ex Benth. and *H. muticum*.

**Etymology.** The specific epithet is derived from the Greek *mikros*, small, little and *-oides*, like, resembling and *Salsola*, a genus of Chenopodiaceae, as the plant superficially resembles a dwarf version of the widespread *S. tragus* L.

**36a. *Heliotropium albrechtii* Craven sp. nov.**

(Fig. 8)

*A. H. geochare* Domin mericarpis minoris (1.3 mm longis), et trichomatibus patentiascendentibus usque patentibus et minoribus (usque 0.2 mm longis) differt.

**TYPUS:** Australia, Northern Territory, 14 km NW of Hamilton Downs homestead, near CSIRO enclosure, 10 March 1997, *Albrecht 8010* (holotype: NT; isotype: CANB).

**Description.** Annual herb, hermaphroditic, erect, up to c. 25 cm tall. Branchlets with hairs of one class, the hairs moderately dense, appressed. Leaves 12–40 mm long, 1.2–3.5 mm wide, short-petiolate. Leaf blade revolute, linear-elliptic; hairs on the abaxial surface uniformly distributed, appressed. Cymes simple, bracteate. Inflorescence bracts on the abaxial surface with the hairs coarse, uniformly distributed, and appressed on the lamina and spreading-ascending on the margin. Calyx lobes with the hairs on the abaxial surface as on the inflorescence bracts, and with the hairs on the margin generally longer than those on the lamina. Corolla white, 4.5 mm long. Anthers ovate, 0.7 mm long, the apex acuminate, coherent at the apex. Gynoeceium 1.1 mm long; ovary 0.4 mm long; style 0.2 mm long; stigmatic apparatus 0.5 mm long, the disc (0.2 mm) fairly equal in length to the cone (0.3 mm). Mericarps with microhairs, the hairs spreading-ascending to spreading and up to c. 0.2 mm long; suborbicular, 1.3 mm long, 1.1 times as long as wide, the apex obtusely acute; commissures strongly pitted, the pit circular, with a very weakly developed food body (no fatty material observed).



*Heliotropium microsalsoides*  
Craven

determined by L. A. Craven  
Australian National Herbarium, CANB 2085

Exsiccatae from collaborative plant exploration  
by the herbaria CANB, DNA, ISC, and Mac Stewart  
of Arkansas, with the major sponsor being the U.S.  
Department of Agriculture (ARS - Germplasm Unit)

AUSTRALIAN NATIONAL HERBARIUM (CANB)  
Commonwealth Scientific & Industrial Research  
Organisation, Australia

BORAGINACEAE

*Heliotropium*

AUSTRALIA, Western Australia

Sunday Island, King Sound.

16° 23' S 121° 10' E

Among ruins of abandoned mission station on sandstone;  
burnt the previous year.

Diocious shrubs to 30 x 60 cm; corolla white.

L. A. Craven and J. McD. Stewart  
9271

2 Jun 1993

25mm

Fig. 7. *Heliotropium microsalsoides* Craven, part of holotype.

New species of *Heliotropium* (Boraginaceae)



25mm  
No  
8.10

*Heliotropium albrechtii*  
Craven

determinavit L.A. Craven  
Australian National Herbarium (CANB)

2005

NORTHERN TERRITORY HERBARIUM  
ALICE SPRINGS (NT) AUSTRALIA

*Heliotropium*

14m NW Hamilton Downs Road, near CSIRO Enclosure

STATE DIST NT 25 23°24-31'S 133°11-16'E

Erect herb with white flowers. OCCASIONAL on heavy soil plain with *Astragalus pectinatus*, *Glycine latifolia* and *Scaevola trachysperma*

Albrecht O.E. 8012

10 MAR 1997

BORAGINACEAE

NT CANB

ADD94882



Fig. 8. *Heliotropium albrechtii* Craven, holotype.



Fig. 9. *Heliotropium viator* Craven, holotype.

**Distribution and ecology.** *Heliotropium albrechtii* has been recorded only in the Hamilton Downs Station region of the Northern Territory (Fig. 10) where it grows on a heavy soil plain with *Astrebla pectinata*, *Glycine falcata* and *Sauropus trachyspermus*.

**Remarks.** The species is a member of the *H. tenuifolium* subgroup within which its closest relative may be *H. geocharis* Domin, a species that occurs in similar habitats on the northern black soil plains of Western Australia, the Northern Territory and Queensland. *Heliotropium geocharis*, however, has bigger mericarps with appressed hairs up to 0.4 mm long.

**Etymology.** The specific epithet honours the collector of the type material, David Edward Albrecht of Alice Springs, Northern Territory. David has made many interesting collections during the course of his work on the Australian arid-zone flora.

**62a. *Heliotropium viator* Craven sp. nov.**

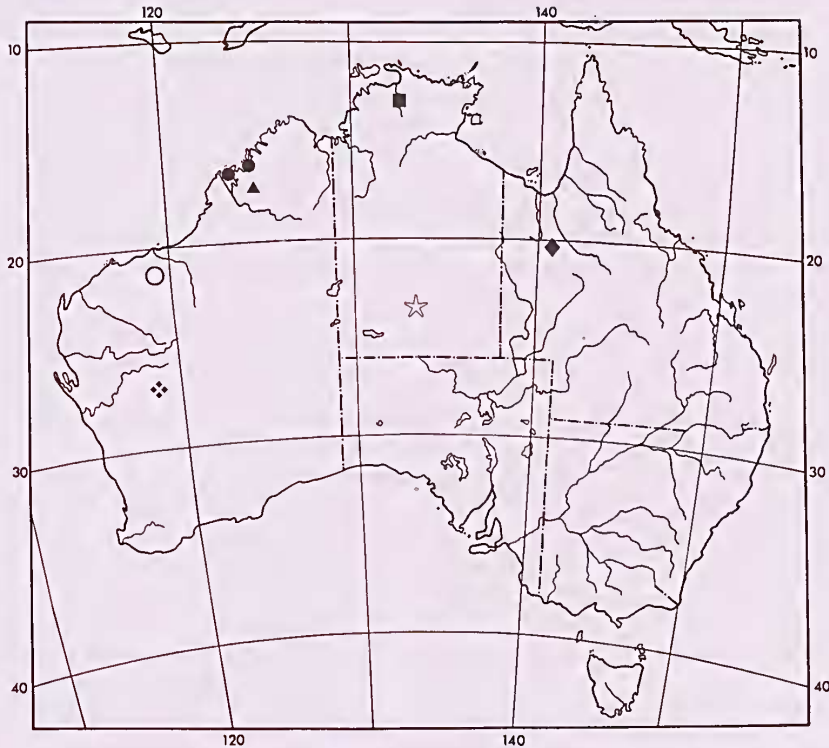
(Fig. 9)

*A. H. tenuifolio* R. Br. lobis calycis trichomatibus grossis, et mericarpis trichomatibus apice hamato differt.

**TYPUS:** Australia, Western Australia, E facing slopes of the Napier Range just N of Wombarella Gap, 12 May 1988, *Goble-Garratt 569* (holotype: PERTH; isotypes: CANB, K *u.v.*).

**Other specimens examined.** Australia. Western Australia: Napier Range, 2 km NNW of Napier Downs Homestead, 13 April 1988, *Cranfield 6332* (MEL, PERTH); 1 km NNW of Barker River Gorge, 20 April 1988, *Cranfield 6470* (CANB, PERTH).

**Description.** Annual (or short-lived perennial?) herb, hermaphroditic, ascending, up to c. 40 cm tall. Branchlets with hairs of one class, the hairs dense, appressed. Leaves 5–15 mm long, 0.7–1.2 mm wide, short-petiolate. Leaf blade revolute, linear; hairs on the abaxial surface uniformly distributed, appressed. Cymes during anthesis straight, simple to several-branched, bracteate. Inflorescence bracts on the abaxial surface with the hairs coarse, uniformly distributed, appressed on the lamina and spreading-ascending on the margin. Calyx lobes with the hairs on the abaxial surface of the lamina generally as long as those on the margin, coarse, uniformly distributed, appressed on the lamina and spreading-ascending on the margin. Corolla white to off-white, 5 mm long. Anthers ovate, 0.8 mm long, the apex acuminate, coherent at the apex. Gynoecium 2.2 mm long; ovary 0.3 mm long; style 1.4 mm long; stigmatic apparatus 0.5 mm long, the disc (0.2 mm) fairly equal in length to the cone (0.3 mm). Mericarps with microhairs, the hairs ascending to spreading-ascending and up to c. 0.2 mm long and generally hooked at the apex; ovate, 0.9–1.1 mm long, 1.3–1.4 times as long as



**Fig. 10.** Distributions of *Heliotropium* species. *H. argyreum* ○; *H. mitchellii* ◇; *H. arenitense* ■; *H. lapidicola* ◆; *H. microsalsoloides* ●; *H. albrechtii* ☆; *H. viator* ▲.

wide, the apex acute; commissures strongly pitted, the pit suborbicular, without a food body.

**Distribution and ecology.** *Heliotropium viator* has been recorded in the Napier Range-Barker River region of Western Australia (Fig. 10) and has been noted to grow on open scree slopes, in shallow brown clay over limestone on a rocky hill-top and slope, and in open tussock grassland with *Adansonia* and *Sorghum* on red clay with exposed limestone outcrops.

**Remarks.** This taxon is a member of the *H. tenuifolium* subgroup as circumscribed by Craven (1996). It is characterised by its limestone-related ecology and the hooked mericarp hairs, the latter feature being unusual in the Australian species of the genus and shared with *H. paniculatum* R.Br.

**Etymology.** The epithet is a noun in apposition, Latin, *viator*, traveller, wayfarer, and refers to the hooked mericarp hairs whereby this species is believed to adhere to animals and thus be dispersed.

#### Partial keys to species of *Heliotropium*

The species described above have been inserted in the keys given in Craven (1996) as follows:

##### 1. Key to *H. argyreum* and *H. mitchellii*

Replace the first lead of couplet 3 in Key 1 (Craven 1996: 534) with the following:

3. Mericarp hairs appressed to spreading-ascending
  - A. Branchlet indumentum seemingly of a single class of hair, these appressed to ascending, sparse small hairs also occur ..... 8a. *H. argyreum*
  - A. Branchlet indumentum consisting of hairs of two classes
    - B. Branchlets with hairs of the larger class frequent; mericarps 1–1.4 mm long..... 13. *H. ovalifolium*
    - B. Branchlets with hairs of the larger class usually sparse; mericarps 2 mm long..... 12a. *H. mitchellii*

##### 2. Keys to *H. arenitense*

Replace couplet 5 in Key 2 (Craven 1996: 535) with the following:

5. Mericarps 1 mm long ..... 23a. *H. arenitense*
5. Mericarps more than 1.2 mm long
  - A. Mericarps 1.6–1.7 mm long, 1.4–1.5 times as long as wide ..... 34. *H. transforme*
  - A. Mericarps 1.3–1.6 mm long, 1.4–2 times as long as wide ..... 35. *H. vestitum*

Replace the first lead of couplet 7 in Key 4 (Craven 1996: 544) with the following:

7. Mericarps with the commissure pit orbicular to suborbicular
  - A. Mericarps with microhairs, ovate to broadly ovate, 1.2–1.4 mm long ..... 27. *H. flaginoides*
  - A. Mericarps glabrous, oblong-ovate, 1 mm long. 23a. .... *H. arenitense*

##### 3. Keys to *H. lapidicola*

Insert after the second lead of couplet 23 in Key 2 (Craven 1996: 536) the following:

- A. Plant a perennial, dioecious subshrub..... 28a. *H. lapidicola*
- A. Plant an hermaphroditic annual.

Insert after the first lead of couplet 51 in Key 2 (Craven 1996: 537) the following:

- A. Mericarp pits elliptic ..... 28a. *H. lapidicola*
- A. Mericarp pits orbicular to suborbicular.

##### 4. Key to *H. microsalsoloides*

Replace the first lead of couplet 1 and couplet 2 in Key 4 (Craven 1996: 544) with the following:

1. Leaf blade on the abaxial surface with the hairs not distributed fairly uniformly
  2. Leaf blade on the abaxial surface with the hairs all appressed..... 24. *H. cupressinum*
  2. Leaf blade on the abaxial surface with the hairs either ascending to spreading or else appressed on the lamina and midrib and spreading-ascending on the margin
    - A. Leaf blade on the abaxial surface with the hairs ascending to spreading ..... 26. *H. epacridemum*
    - A. Leaf blade on the abaxial surface with the hairs appressed on the lamina and midrib and spreading-ascending on the margin... 28b. .... *H. microsalsoloides*

##### 5. Keys to *H. albrechtii*

Replace the second lead of couplet 22 in Key 2 (Craven 1996: 536) with the following:

- 22 Mericarps broadly ovate or suborbicular, the commissures moderately to strongly pitted
  - A. Mericarps 0.8–1.1 mm long; calyx lobes with the hairs on the margin generally equal in length to shorter than those on the lamina..... 15. *H. paniculatum*
  - A. Mericarps 1.3 mm long; calyx lobes with the hairs on the margin generally longer than those on the lamina..... 36a. *H. albrechtii*

Replace the second lead of couplet 61 in Key 2 (Craven 1996: 538) with the following:

61. Mericarps 1–1.4 mm long
  - A. Mericarps with weakly developed food bodies; leaf blade on the abaxial surface with the hairs appressed; gynoeceium 1.1 mm long ..... 36a. *H. albrechtii*
  - A. Mericarps without food bodies; leaf blade on the abaxial surface with the hairs appressed on the lamina and appressed to spreading-ascending on the margin; gynoeceium 2 mm long ..... 53. *H. melanopedii*

6. Key to *H. viator*

Insert after the first lead of couplet 17 in Key 2 (Craven 1996: 535) the following:

- 17A. Mericarps with at least some of the hairs hooked at the apex
  - B. Gynoeceium 0.8–1.2 mm long; mericarps broadly ovate, 1–1.1 times as long as wide .....  
..... 15. *H. paniculatum*
  - B. Gynoeceium 2.2 mm long; mericarps ovate, 1.3–1.4 times as long as wide..... 62a. *H. viator*
- A. Mericarps without hooked hairs.

Insert after the second lead of couplet 17 in Key 2 (Craven 1996: 537) the following:

- A. Mericarps with at least some of the hairs hooked at the apex ..... 62a. *H. viator*
- A. Mericarps without hooked hairs.

ACKNOWLEDGMENTS

The Directors and/or Curators of the following herbaria are thanked for the opportunity to study collections in their care: CANB, NT, PERTH. I especially wish to acknowledge the many people who have been collecting and/or sending specimens, doubtless in the desire to further extend my frustration with this taxonomically complex group of plants: without your interest our knowledge of this rich component of the Australian flora would be significantly poorer. Prof. Hartmut Hilger is thanked for his generous and speedy provision of publications, and for presenting a seminar in Canberra on the phylogenetic studies of Boraginaceae s.l. being conducted in his laboratory. The images were taken and prepared by Carl Davies.

REFERENCES

- Anonymous. 2005. *Index herbariorum: a global directory of public herbaria and associated staff*. URL: <http://sciweb.nybg.org/scincc2/IndexHerbariorum.asp> (Accessed 31 January 2005)
- Craven, L.A. 1996. A taxonomic revision of *Heliotropium* (Boraginaceae) in Australia. *Australian Systematic Botany* 9: 521–657.
- Diane, N. 2003. Systematic analysis of the Heliotropiaceae based on molecular and morphological-anatomical data. PhD thesis, FU Berlin. URL: <http://www.diss.fu-berlin.de/2003/197/index.html>
- Diane, N. Jacob, C. and Hilger, H.H. 2003. Leaf anatomy and foliar trichomes in Heliotropiaceae and their systematic relevance. *Flora* 198: 468–485.
- Diane, N., Förther, H., Hilger, H.H. and Weigend, M. In press. Heliotropiaceae Schrad. In: Kubitzki, K. (ed.) *Families and genera of the flowering plants*. Springer: Berlin.
- Hilger, H.H. and Diane, N. 2003. A systematic analysis of Heliotropiaceae (Boraginales) based on trnL and ITS1 sequence data. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 125: 19–51.

Accepted 24 November 2004